Attachment 6

The RU Review Questions on BNFL March 2000 Topical Meeting Submittal, "Topical Report on HLW/LAW Melters and Offgas Systems," RPT-W375-SA00009, Rev. B

1. Several systems discussed in the melter topical have not been designed. When will they be designed, and how will the hazard analysis be modified to recognize their impact on the hazard analysis, if any?

Frit addition system (Section 2.1.2.2.2)
Thermal insulating layer for cooling panels (2.1.3.3)
Melter feed pump (if non-ADS selected) (2.1.5.1)
Portions of the design having to do with maintenance, operation in a nuclear facility, disposal and other features not included in the pilot melter testing program. (2.2.2) (Note that Table 2-2 does not present such features, as indicated; e.g. number of electrodes, melt pool aspect ration, melter length are left to "detailed design")
LAW melter offgas system process flow diagrams, piping and instrumentation diagrams, and mass balance of the system (2.3.1)
Method to clean the offgas line from the film cooler to the SBS (2.3.2.1.1)
Submerged Bed Scrubber (2.3.2.1.3)
Wet Electrostatic Precipitator (2.3.2.1.4), including voltage, flows, pressures, cooling agent, and discussion of "Croll-Reynolds proprietary indirect cooling" method
Catalytic Oxidizer/Reducer Unit (Figure 2-8)
Vessel Flow Rates of the Vessel ventilation system (Table 2-5) (Less than 15 gpm includes 0 gpm, probably not an acceptable design value)

2. Which hazardous situation addresses failure to control the special jackbolt adjustment tool direction, speed, and torque (Section 2.1.2.2.3)?

3. In the event of glass "break out" due to larger than anticipated cracks in the refractory, or between refractory blocks, what is the largest crack size accounted for in the design, and the basis for this assumption? For this design crack size what is the temperature profile expected? Is data available to support this model, for such an occurrence, or is data limited to the one dimensional model of Appendix E? To what extent has the hazard analysis to date accounted for glass "break out?" (2.1.2.2.3, and Appendix E)

4. Quantify the mechanism of refractory material corrosion with excessive temperature discussed in 2.1.3.1. (How does the selected measure of corrosion vary with time and temperature?)

5. Provide a detailed description of the "Monofrax K3" and "AZS" refractory bricks to be used; i.e. composition, manufacture, physical and chemical properties. (2.1.3.1.1)

6. What material, specifically, will the cooling panels be fabricated from? (2.1.3.1) What temperature will the cooling jacket wall be exposed to in the design "break out" event? What is the maximum temperature that the cooling jacket wall can be exposed to without structural damage? Is any instrumentation available in the current design to indicate that the jacket is being subjected to excessive temperature?

7. Are the multi-junction glass pool thermocouples (2.1.4.4) capable of measuring temperature at several elevations in the melt? Please elaborate on their capability in this regard. How many thermocouples were assumed to be operating for purposes of the hazard analysis (2.1.4.5)?

8. What is the arrangement, number, and capability of the plenum thermocouples? (2.1.5.2)

9. What was assumed to occur, for the hazard analysis, with respect to lowering glass level in the LAW melter prior to disposal? (2.1.6 is ambiguous; viz. "it has been proposed.")

10. How will the bubbler control system measure glass density, and glass pool temperature profile, as stated in 2.1.8.3?

11. How have ALARA and RAMI been considered in the design of melter airlift tubes, level detectors, feed nozzles, feed lines, viewing cameras, offgas line sections and the film coolers? (2.1.10)

12. What was the location, chemical and physical nature of the offgas deposits that were "particularly difficult to remove?" (2.2.1) How will plenum temperature be controlled so as to avoid accumulation of such deposits?

13. Justify the assumption that the design of the melter primary offgas system for intermittent surges of 7X steam flow or 3X noncondensable flow provides adequate capacity to operate the melter in accordance with the radiation exposure standards, including ALARA, and with the NESHAPs. Provide the associated calculation or data. (2.3.1)

14. Define "R3/C5 area." (2.3.1)

15. DOE 5400.5 is cited as the enveloping standard for federal, state, and local air emission requirements, at the point of discharge to the stack. (2.3.2) Is this standard is in the Safety Requirements Document?

16. What are the melter failure modes discussed in Peters (1999) (2.3.4) Were these failure modes included in the hazard analysis done to date?

17. How is solids buildup in the film cooler "determined?" (2.3.4.1.1) In such a case, by design, how will feed be stopped?

18. If the unit preheater to the catalytic oxidation/reduction unit fails, at what rate will ammonium nitrate accumulate if the ammonia gas mixture feed is not stopped? Which hazardous situation addresses this scenario? In such a case, by design, how will the ammonia gas mixture feed be stopped? (2.3.4.2.4)

19. 11th line from bottom of page, "have severity level unmitigated consequences" appears to be a typographic error. Which severity level?

20. The HLW hazard discussion references the design documentation used as the basis for the hazard analysis, while the corresponding LAW hazard discussion does not. Identify the LAW design documentation that was used as the basis for the hazard analysis performed to date. Also, identify the reason for the extensive revisions in the HLW hazard discussion information indicated by change bars.

21. Table 2-7, page 48, situation CSD-L210/0017, is for spread of contamination, yet lists "glass would freeze in the lines" as a control strategy. This does not address gaseous or particulate contamination.

22. Table 2-7, page 47, situation CSD-L210/0012, is for a glass pour when not expected, and lists the event as "not credible" due to multiple level indicators. During cold testing, WVDP encountered a large pour event due to melter pressurization because the melter air inbleed valve opened instead of closed. This event deserves additional review.

23. Table 2-7, page 55, situation CSD-L220/NO17, lists a failure of the pour air lift resulting in continued pour when the container is already full. Restricted access and negative pressure are listed as control strategies. These are mitigation features. The preventive control strategies should be listed.

24. Table 2-7, page 57, situation CSD-L230/N0036, describes an event where a backflow of radioactive or toxic gas occurs during maintenance on the idle melter. The event was determined to be incredible because the operating SBS for the operating melter would block surge flow from the offgas header. Experience at WVDP shows that maintaining constant melter pressure was extremely difficult for one melter offgas fan. Some additional discussion regarding the operation of 3 melters with a common secondary offgas system and fans is needed.

25. Table 3-4, page 113, situation CSD-H230/012, described an event where the offgas plenum is blocked by high liquid level in the SBS. Why was this event deleted from Rev. B.

26. What process will be used by BNFL to dispose I-129 and other radionuclides collected in the offgas system?

27. "Topical Report on HLW/LAW Melters and Offgas Systems", Section 2.1.3.5 "Melter Shell" notes that to reduce the deposition of materials (both corrosive salts and radionuclides) a small purge will be provided for the annular space between the cooling

panels and the shell. "This purge will be driven by melter vacuum, and will result in approximately 10 annular space gas volume changes per hour."

Question: Has BNFL considered installation of a HEPA filters on the manifold for the air supply to the annular space to prevent additional contamination of the melter cell if (and when) a melter pressure excursion causes backflow from the melter into the cell?

28. In describing a standby line for relieving excessive melter pressure to the SBS, Section 2.3.2.1.2 "Offgas Line from the Melter to the SBS" states : "To maintain the line clean and prevent plugging, a small back flow of air is allowed through the line." The "standby" line is "nearly identical except for the addition of a butterfly valve", i.e., 10 in. diameter.

    Question: How will BNFL monitor the condition of the standby line so that it remains unobstructed by debris and ready to perform its pressure-relieving function when the melter pressure rises?

    Question: What is the flowrate of backflow air necessary to keep the standby line in an unobstructed condition?

29. The pressure relief valve, provided to handle melter overpressures resulting from offgas surges exceeding 7X steam and 3X noncondensables, is shown *downstream* of the butterfly valve in the standby line to the SBS scrubber. The relief valve is thereby protected from potential blockage from deposition of debris from the hot melter offgas, but will depend on the butterfly valve's opening to perform its safety function.

    Question: How has BNFL determined the location of the pressure relief valve, i.e., *upstream* or *downstream* of the butterfly valve?

30. Figure 2-2. "LAW Melter Offgas System Block Diagram" and accompanying text indicates that pressure in individual melters will be controlled by adjusting the flowrate of process air introduced via the film cooler. This scheme will be replicated for the other melters. Falling vacuum (increasing pressure) in a melter will be compensated for by reducing the influx of process air to that melter. This will tend to cause the fans to pull a greater vacuum on the other melters, whose pressure controls will attempt to compensate by increasing the air flows to their respective melters. Control system instability may result in melter pressure relief valves opening (unnecessarily) frequently, releasing untreated melter offgas to the cell. (Section 2.3.2.2.1 "HEPA Preheaters, Filters and Exhauster" states that six variable speed exhausters (fans) "provide the motive force for offgas movement and control melter pressure.")

    Question: How will BNFL design the melters' pressure control system to reduce control system interaction and instability?

31. Section 2.3.2.1.2 "Offgas Line from the (LAW) Melter to the SBS" states: "Times when this pressure relief valve could be activated is during normal operations when personnel

access is not allowed to the cell". Section 3.2.4.2.2 "Standby Bypass Valve" (for the HLW melter) notes that "If the melter offgas standby valve fails to open during a high melter surge, the melter offgas would be bypassed through the melter pressure relief valve." The performance requirements/assumptions for LAW Melter Event CSD-L210/0023 notes that the "Offgas system shall include an emergency vent routed to a suitable location" without specifying the location (the cell according to Section 2.3.2.1.2).

Question: What is the rationale for assuming that melter overpressures requiring relief to the LAW melter cell cannot occur when the melters are in a mode "permitting access to the cell by personnel"?

Question: Where does the corresponding HLW melter's offgas system vent to? The cell?

32. Section 2.3.2.1.3 "Submerged Bed Scrubber" states: "If maintenance of the offgas line is required during the lifetime of the melter, a bypass line from the standby offgas line to downstream of the WESP is provided to isolate the area and allow melter venting during maintenance. The bypass line is only opened when the melter is in idled mode." A similar arrangement is described in Section 3.2.2.3.2 "Standby HLW Melter Offgas Treatment System" for the HLW melter. The HLW melter's idle mode is noted several times in Section 3.2.4.1 "Primary HLW Melter Offgas Treatment System", but what constitutes the idle mode is unclear.

    Question: How is "melter idle mode" defined? For example, are film cooler air flows and glass bubbler air flows cut off in melter idle mode? Was the "melter in idled mode" examined during the ISM Cycle 2 effort?

    Question: What are the safety consequences of inadvertently leaving the bypass valve open after maintenance? Could the HEPA filters downstream be damaged?

33. Section 2.3.2.2.3 "Caustic Scrubber" states: This scrubber (for LAW) is designed for a maximum capacity of 6,700 cfm and has dimensions of 4.3 ft diameter and 14 ft high....The offgas flows countercurrent to the scrubbing liquid, which is introduced through a distributor at the top of the packed section of the column and trickles downward through the packing media." Depending on the type of packing used, the 4.3 ft diameter column could flood at 6,700 cfm gas flow. An airborne spray of 5 M caustic soda solution could be ejected from the process exhaust stack, possibly affecting collocated workers.

    Question: Was flooding of the LAW and HLW caustic scrubbers analyzed during ISM Cycle 2?

34. Table 3-4 "ISM Results for HLW Melter Systems", Situation ID CSD-H210/025 notes the "potential shock hazard to workers through MSM or damage to in-cell equipment cranes, MSM etc." The control strategy involves grounding the melter. (The glass is electrically conductive when molten.)

Question: Will the glass receiving canister need to be isolated from ground during a pour of glass?

Question: How will instrumentation components, e.g., the canister glass-level indicator be electrically isolated from the glass to ensure reliable readings of process parameters?